

PATENT COOPERATION TREATY

PCT


INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 14 JAN 2005

WIPO

PCT

Applicant's or agent's file reference SMR/P550634PC	FOR FURTHER ACTION		See Form PCT/PEA/416
International application No. PCT/GB2004/001123	International filing date (day/month/year) 17.03.2004	Priority date (day/month/year) 22.03.2003	
International Patent Classification (IPC) or national classification and IPC E21B43/34			
Applicant CALTEC LIMITED et al			
1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36. 2. This REPORT consists of a total of 6 sheets, including this cover sheet. 3. This report is also accompanied by ANNEXES, comprising: a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 5 sheets, as follows: <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).			
4. This report contains indications relating to the following items: <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application			
Date of submission of the demand 29.09.2004	Date of completion of this report 17.01.2005		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Dantine, P Telephone No. +31 70 340-3396		



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/001123

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-10 as originally filed

Claims, Numbers

1-42 filed with telefax on 29.09.2004

Drawings, Sheets

1/4-4/4 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/001123

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	3-6,8,9,11,13-17,20,22,24,26,27,29,31,33-37,40,42
	No: Claims	1,2,7,10,12,18,19,21,23,25,28,30,32,38,39,41
Inventive step (IS)	Yes: Claims	
	No: Claims	1 - 42
Industrial applicability (IA)	Yes: Claims	1 - 42
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

- D1: WO 95/07414 A (SARSHAR MIR MAHMOOD ;BHR GROUP LTD (GB)) 16 March 1995 cited in the application
- D2: GB-A-2 239 676 (BHR GROUP LTD) 10 July 1991
- D3: GB-A-2 014 862 (INST FRANCAIS DU PETROL) 5 September 1979
- D4: US-A-3 590 919 (TALLEY WILLIAM A JR) 6 July 1971
- D5: WO 02/18746 A (ABB RESEARCH LTD ;BRINGEDAL BJORN OEYVIND (NO); NOEKLEBERG LARS (N) 7 March 2002

1) The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 is not new in the sense of Article 33(2) PCT.

1.1) The document **D1** discloses (the references in parentheses applying to this document; see fig.3; page 4 line 12 - 27):

A system for pumping multiphase fluids, the system including:

- a phase separator (42) that is connected to receive a LP multiphase fluid (11), and is constructed and arranged to separate a LP gas phase (42G) and a LP liquid phase (42L) from the LP multiphase fluid (11);
- a gas-gas jet pump (32) having a LP inlet connected to receive the LP gas phase (42G) from the phase separator (42), a HP inlet connected to receive a HP gas supply (41G) from a sustainable gas source, and an outlet for providing outlet gas (43G) at a pressure higher than that of the LP gas phase (42G);
- and a liquid pump (31) having a LP inlet connected to receive the LP liquid phase (42L) from the phase separator (42), and an outlet for providing outlet liquid (43) at a pressure higher than that of the LP liquid phase (42L).

D1 discloses the use of gas from a high pressure well as a sustainable gas source. HP wells have a wide range of pressure and a pressure range of 50-150 bar is considered

an implicit feature of D1 (See guidelines C-IV- 7.2) The pressure required is obviously dependent of the LP pressure gas well which need to be boosted. The pressure required for the motive fluid will be determined by the man skilled in the art knowing the pressure of the well to be boosted. He will use whatever fluid is easily available and at low cost. This might be high pressure gas from high pressure wells or other sources available at the well site like gas lift, export gas or even simply the use of a compressor.

The subject-matter of claim 1 is therefore not new (Article 33(2) PCT).

2) The same reasoning applies, *mutatis mutandis*, to the subject-matter of the corresponding independent claim 23, which therefore is also considered not new.

3) Dependent claims 2-22 and 24-42 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step for the following reasons:

Claims 2-4,24,25: As a drive medium for a jet pump, the man skilled in the art will use whatever fluid is easily available and low cost. Lift gas is well known to lift well fluid and is an obvious choice as a drive medium. Export gas is disclosed in D1 as it is gas from other HP wells. D2 discloses the use of a compressor (16') to use gas as a drive medium in a jet pump (17). Steam is often used in stimulation operations and is also an obvious option for the man skilled in the art.

Claims 5,6,13,14,20,22,26,27,29,33,34,40,42: The subject-matter of these claims consists in the selection of a range of pressure/ratio. Such a selection can only be regarded as inventive, if the range presents unexpected effects or properties in relation to the rest of the range. However, no such effects or properties are indicated in the application. Hence, no inventive step is present in the subject-matter of these claims.

Claims 7-9,28: D3 discloses the use of a mechanical pump to pump the liquid. Also disclosed in D1 (fig.5; réf. 55). PDM is an obvious choice. D3 discloses similar outlet pressure for liquid and gas phases (page 1 line 52 - 70).

Claims 10-12,30-32: D1 discloses a liquid-liquid jet pump (41). HP liquid phase from HP wells is considered as a sustainable source. D5 (fig. 1 réf. 6) discloses the use of injection water as a drive medium to entrain another fluid. D1 also discloses the use of HP oil (41L) from other wells as drive medium.

Claims 15,16,35,36: D4 discloses a knock-out vessel for the same purpose.

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2004/001123

Claims 17,37: a cyclone separator is usual in such process (see also cited documents in the application).

Claims 18,19,21,38,39,41: D1 and D3 discloses a mixing device (6) for combining gas and liquid phases. A commingler is an obvious choice. D3 is about producing multiphasic oil effluents.

CLAIMS

1. A system for pumping multiphase fluids, the system including:
 - a phase separator that is connected to receive a LP multiphase fluid, and is constructed and arranged to separate a LP gas phase and a LP liquid phase from the LP multiphase fluid;
 - a gas-gas jet pump having a LP inlet connected to receive the LP gas phase from the phase separator, a HP inlet connected to receive a HP gas supply from a sustainable gas source, and an outlet for providing outlet gas at a pressure higher than that of the LP gas phase;
 - and a liquid pump having a LP inlet connected to receive the LP liquid phase from the phase separator, and an outlet for providing outlet liquid at a pressure higher than that of the LP liquid phase;
 - wherein the sustainable gas source has a pressure in the range 50-150 bar.
2. A system according to claim 1, wherein the sustainable gas source comprises a supply of lift gas or export gas.
3. A system according to claim 1, wherein the sustainable gas source comprises a supply of steam from geothermal wells.
4. A system according to any one of the preceding claims, wherein the sustainable gas source includes a compressor.
5. A system according to any one of the preceding claims, wherein the HP gas supply has a pressure at least twice that of the LP gas phase.
6. A system according to any one of the preceding claims, wherein the gas-gas jet pump has an outlet pressure in the range 1.1 to 3.0 times the pressure of the LP multiphase fluid.
7. A system according to any one of the preceding claims, wherein the liquid pump is a mechanical pump.

12

8. A system according to claim 7, wherein the liquid pump is a positive displacement pump.
9. A system according to claim 7 or claim 8, wherein the liquid pump has an outlet pressure similar to that of the gas-gas jet pump.
10. A system according to any one of claims 1 to 6, wherein the liquid pump is a liquid-liquid jet pump having a LP inlet connected to receive the LP liquid phase from the phase separator, a HP inlet connected to receive a HP liquid supply from a sustainable liquid source, and an outlet for providing outlet liquid at a pressure higher than that of the LP liquid phase
11. A system according to claim 10, wherein the sustainable liquid source comprises a supply of injection water.
12. A system according to claim 10, wherein the sustainable liquid source comprises a supply of export oil.
13. A system according to any one of claims 10 to 12, wherein the sustainable liquid source has a pressure at least twice that of the LP liquid phase.
14. A system according to any one claims 10 to 13, wherein the liquid-liquid jet pump has an outlet pressure in the range 1.1 to 3.0 times that of the LP liquid phase.
15. A system according to any one of the preceding claims, including a knock-out vessel for removing retained liquid from the LP gas phase.
16. A system according to claim 15, wherein the knock-out vessel has a liquid outlet connected to deliver removed liquid to the liquid pump.
17. A system according to any one of the preceding claims, wherein the separator is a cyclone type separator.
18. A system according to any one of the preceding claims, including a mixing device connected to the outlets of the jet pump and the liquid pump, for combining the outlet gas and the outlet liquid and providing a combined multiphase outlet fluid at a pressure higher than that of the LP multiphase fluid
19. A system according to claim 18, wherein the mixing device is a commingler.

13

20. A system according to claim 18 or claim 19, wherein the combined multiphase outlet fluid has an outlet pressure in the range 1.1 to 3.0 times that of the LP liquid phase.
21. A system according to any one of claims 18 to 20, wherein the multiphase fluid is a petroleum gas/oil mixture.
22. A system according to claim 21, wherein the gas/liquid ratio of the petroleum gas/oil mixture is in the range 9 to 49 at the operating pressure and temperature.
23. A process for pumping multiphase fluids, the process including:
- separating a LP multiphase fluid into a LP gas phase and a LP liquid phase;
 - increasing the pressure of the LP gas phase using a gas-gas jet pump, by supplying a HP gas supply from a sustainable gas source to a HP inlet of the jet pump and supplying the LP gas phase to a LP inlet of the jet pump;
 - and increasing the pressure of the LP liquid phase using a liquid pump,
 - wherein the sustainable gas source has a pressure in the range 50-150 bar.
24. A process according to claim 23, wherein the sustainable gas source comprises a supply of lift gas.
25. A process according to claim 23, wherein the sustainable gas source comprises a supply of export gas.
26. A process according to any one of claims 23-25, wherein the sustainable gas source has a pressure at least twice that of the LP gas phase.
27. A process according to any one of claims 23-26, wherein the gas-gas jet pump has an outlet pressure in the range 1.1 to 3.0 times the pressure of the LP multiphase fluid.
28. A process according to any one of claims 23-27, wherein the liquid pump is a mechanical pump.

14

29. A process according to claim 28, wherein the liquid pump has an outlet pressure in the range 1.1 to 3.0 times the pressure of the LP multiphase fluid.
30. A process according to any one of claims 23 to 27, wherein the liquid pump is a liquid-liquid jet pump having a LP inlet connected to receive the LP liquid phase, and a HP inlet connected to receive a HP liquid supply from a sustainable liquid source.
31. A process according to claim 30, wherein the sustainable liquid source comprises a supply of injection water.
32. A process according to claim 31, wherein the sustainable liquid source comprises a supply of export oil.
33. A process according to any one of claims 23-32, wherein the sustainable liquid source has a pressure at least twice that of the LP multiphase fluid.
34. A process according to any one of claims 23-33, wherein the liquid-liquid jet pump has an outlet pressure in the range 1.1 to 3.0 times that of the LP multiphase fluid.
35. A process according to any one of claims 23-34, in which retained liquid is removed from the LP gas phase using a knock-out vessel.
36. A process according to claim 35, wherein removed liquid is delivered to the liquid pump.
37. A process according to any one of claims 23-36, wherein the LP gas and liquid phases are separated in a cyclone type separator.
38. A process according to any one of claims 23-37, including mixing the increased pressure gas and liquid phases to provide a combined multiphase fluid at a pressure higher than that of the LP multiphase fluid
39. A process according to claim 38, wherein increased pressure gas and liquid phases are mixed in a commingler.
40. A process according to any one of claims 38-39, wherein the combined multiphase outlet fluid has an outlet pressure in the range 1.1 to 3.0 times that of the LP multiphase fluid.

15

41. A process according to any one of claims 38-40, wherein the multiphase fluid is a petroleum gas/oil mixture.
42. A process according to claim 41, wherein the gas/liquid ratio of the petroleum gas/oil mixture is in the range 9 to 49 at the operating pressure and temperatures.